We claim:

1. A method for sensing a physical condition, the method comprising:

(a) generating light;

(b) passing a first portion of the light through a first optical path comprising a first optical fiber, the first optical fiber being characterized by a first optical path length which changes in response to the physical condition;

(c) passing a second portion of the light through a second optical path comprising a second optical fiber, the second optical fiber being characterized by a second optical path length which changes in a controllable manner;

(d) causing the first portion of the light which has passed through the first optical path to interfere with the second portion of the light which has passed through the second optical path;

(e) changing the second optical path length until step (d) results in an interference fringe having a maximum; and

(f) determining the physical condition in accordance with a value of the second optical path length corresponding to the maximum of the interference fringe.

2. The method of claim 1, wherein the second optical path length does not change in response to the physical condition.

3. The method of claim 1, wherein the light has a coherence length, and wherein the second optical path length has a maximum amount of change which is greater than the coherence length.

4. The method of claim 1, wherein step (e) comprises changing a physical length of the second optical fiber.

5. The method of claim 4, wherein the physical length of the second optical fiber is changed through stretching the second optical fiber.

6. The method of claim 5, wherein the second optical fiber is wrapped around a piezoelectric element and is stretched by controlling the piezoelectric element to expand.

7. The method of claim 4, wherein the physical length of the second optical fiber is changed through compressing the second optical fiber.

8. The method of claim 1, wherein the first optical path further comprises a third optical fiber having a third optical path length which is constant.

9. The method of claim 8, wherein the second optical path further comprises the first optical fiber.

10. The method of claim 9, wherein steps (b) and (c) are performed by:

(i) passing the first and second portions of the light through the first optical fiber;

(ii) passing the first portion of the light through the third optical fiber; and

(iii) passing the second portion of the light through the second optical fiber.

11. The method of claim 10, wherein:

step (i) comprises coupling the light generated in step (a) into the first optical fiber through a first coupler, reflecting the light back through the first optical fiber and the first coupler, and coupling the light from the first coupler into a second coupler to divide the light into the first and second portions;

step (ii) comprises coupling the first portion of the light from the second coupler into the third optical fiber; and

step (iii) comprises coupling the second portion of the light from the second coupler into the second optical fiber.

12. The method of claim 11, wherein step (d) comprises reflecting the first portion of the light back through the third optical fiber, reflecting the second portion of the light back through the second optical fiber, and recombining the first and second portions of the light in the second coupler.

13. The method of claim 12, wherein:

each of the second and third optical fibers comprises a mirror for reflecting the light; and

the first optical fiber comprises a partial mirror and a mirror which define the first optical path length between them.

14. The method of claim 12, wherein the interference fringe has the maximum when the first optical path length equals a difference between the second and third optical path lengths.

15. The method of claim 1, wherein the first optical fiber is bonded to a structure in which the physical condition is to be measured.

16. The method of claim 1, wherein the first optical fiber is embedded in a structure in which the physical condition is to be measured.

17. The method of claim 1, wherein the first optical fiber is attached only at two end points of the first optical fiber to a structure in which the physical condition is to be measured.

18. The method of claim 17, wherein the physical condition comprises a displacement between the two end points.

19. The method of claim 1, wherein the physical condition comprises displacement.

20. The method of claim 1, wherein the physical condition causes an elongation of the first optical fiber relative to an initial state of the first optical fiber.

21. The method of claim 1, wherein the physical condition causes a contraction of the first optical fiber relative to an initial state of the first optical fiber.

22. The method of claim 21, wherein the initial state is a pre-tensioned state.

23. The method of claim 1, wherein:

step (b) comprises passing at least one further portion of the light through at least one further optical path comprising at least one further optical fiber, the at least one further optical fiber being characterized by at least one further optical path length which changes in response to the physical condition;

step (d) comprises causing the at least one further portion of the light which has passed through the at least one further optical path to interfere with the second portion of the light which has passed through the second optical path;

step (e) comprises changing the second optical path length until step (d) results in a plurality of interference fringes, each having a local maximum; and

step (f) comprises determining the physical condition experienced by the first optical fiber and each of the at least one further optical fiber in accordance with a value of the second optical path length corresponding to the local maximum of each of the plurality of interference fringes.

24. The method of claim 1, wherein each of the first and second optical fibers is a single-mode optical fiber.

25. A sensing system for sensing a physical condition, the sensing system comprising:

a source of light;

a first optical path comprising a first optical fiber, the first optical fiber being characterized by a first optical path length which changes in response to the physical condition;

a second optical path comprising a second optical fiber, the second optical fiber being characterized by a second optical path length which changes in a controllable manner;

at least one coupler for causing first and second portions of the light from the source to pass through the first and second optical paths and for causing the first portion of the light

which has passed through the first optical path to interfere with the second portion of the light which has passed through the second optical path;

a photodetector for detecting an interference fringe between the first and second portions of the light and for outputting a signal representing the interference fringe;

an actuator for changing the second optical path length until the interference fringe has a maximum; and

a system, receiving the signal from the photodetector, for permitting a determination of the physical condition in accordance with a value of the second optical path length corresponding to the maximum of the interference fringe.

26. The sensing system of claim 25, wherein the second optical path length does not change in response to the physical condition.

27. The sensing system of claim 25, wherein the light from the source has a coherence length, and wherein the second optical path length has a maximum amount of change which is greater than the coherence length.

28. The sensing system of claim 25, wherein the actuator changes a physical length of the second optical fiber.

29. The sensing system of claim 28, wherein the actuator changes the physical length of the second optical fiber through stretching the second optical fiber.

30. The sensing system of claim 29, wherein the actuator comprises a piezoelectric element, and wherein the second optical fiber is wrapped around the piezoelectric element and is stretched by controlling the piezoelectric element to expand.

31. The sensing system of claim 28, wherein the actuator changes the physical length of the second optical fiber through compressing the second optical fiber.

32. The sensing system of claim 25, wherein the first optical path further comprises a third optical fiber having a third optical path length which is constant.

33. The sensing system of claim 32, wherein the second optical path further comprises the first optical fiber.

34. The sensing system of claim 33, wherein the at least on coupler passes the first and second portions of the light through the first optical fiber, passes the first portion of the light through the third optical fiber and passes the second portion of the light through the second optical fiber.

35. The sensing system of claim 34, wherein:

the at least one coupler comprises a first coupler and a second coupler;

the first coupler couples the light from the source into the first optical fiber;

the first optical fiber comprises a mirror for reflecting the light back through the first optical fiber and the first coupler;

the first coupler couples the light reflected back through the first optical fiber into the second coupler to divide the light into the first and second portions; and

the second coupler couples the first portion of the light into the third optical fiber and couples the second portion of the light coupler into the second optical fiber.

36. The sensing system of claim 35, wherein:

each of the second and third optical fibers comprises a mirror for reflecting light back through said each of the second and third optical fibers; and

the second coupler recombines the first and second portions of the light.

37. The sensing system of claim 36, wherein the first optical fiber further comprises a partial mirror, and wherein the mirror and the partial mirror of the first optical fiber define the first optical path length between them.

38. The sensing system of claim 36, wherein the interference fringe has the maximum when the first optical path length equals a difference between the second and third optical path lengths.

39. The sensing system of claim 25, wherein the first optical fiber is bonded to a structure in which the physical condition is to be measured.

40. The sensing system of claim 25, wherein the first optical fiber is embedded in a structure in which the physical condition is to be measured.

41. The sensing system of claim 25, wherein the first optical fiber is attached only at two end points of the first optical fiber to a structure in which the physical condition is to be measured.

42. The sensing system of claim 41, wherein the physical condition comprises a displacement between the two end points.

43. The sensing system of claim 25, wherein the physical condition comprises displacement.

44. The sensing system of claim 25, wherein the physical condition causes an elongation of the first optical fiber relative to an initial state of the first optical fiber.

45. The sensing system of claim 25, wherein the physical condition causes a contraction of the first optical fiber relative to an initial state of the first optical fiber.

46. The sensing system of claim 45, wherein the initial state is a pre-tensioned state.

47. The sensing system of claim 25, further comprising at least one further optical fiber, the at least one further optical fiber being characterized by at least one further optical path length which changes in response to the physical condition.

48. The sensing system of claim 48, wherein each of the first and second optical fibers is a single-mode optical fiber.

49. A sensing instrument for use with a sensor in sensing a physical condition, the sensing instrument comprising:

a source of light;

a reference optical fiber having a fixed optical path length;

an adjustable optical fiber having a controllably adjustable optical path length;

at least one optical coupler for causing the light from the source to pass through the sensor, receiving the light which has passed through the sensor, splitting the light which has passed through the sensor to the reference optical fiber and the adjustable optical fiber, and causing the light which has passed through the reference optical fiber to interfere with the light which has passed through the adjustable optical fiber;

a photodetector for detecting an interference fringe between the light which has passed through the reference optical fiber and the light which has passed through the adjustable optical fiber;

an actuator for changing the controllably adjustable optical path length until the interference fringe has a maximum; and

a system, receiving the signal from the photodetector, for permitting a determination of the physical condition in accordance with a value of the second optical path length corresponding to the maximum of the interference fringe.

50. The sensing instrument of claim 49, wherein the actuator changes a physical length of the adjustable optical fiber.

51. The sensing instrument of claim 50, wherein the actuator changes the physical length of the adjustable optical fiber through stretching the adjustable optical fiber.

52. The sensing instrument of claim 51, wherein the actuator comprises a piezoelectric element, and wherein the adjustable optical fiber is wrapped around the piezoelectric element and is stretched by controlling the piezoelectric element to expand.

53. The sensing instrument of claim 50, wherein the actuator changes the physical length of the second optical fiber through compressing the second optical fiber.

54. The sensing instrument of claim 49, wherein the light from the source has a coherence length, and wherein the adjustable optical path length has a maximum change which is greater than the coherence length.